

# ChatGPT in biomedical research

Shengping Yang PhD, Gilbert Berdine MD

**S**tarting from the beginning of 2023, ChatGPT has become a focal point of numerous mainstream media discussions. The excitement surrounding this innovative technology is tangible, with its potential appearing to be truly remarkable. As a researcher in the biomedical field, what are the prospects of integrating ChatGPT or other generative AI models into my research?

## 1. AN IMPRESSIVE ACHIEVEMENT

On November 30, 2022, OpenAI introduced a preliminary demonstration of ChatGPT. Within just five days, it garnered an impressive one million subscriptions, highlighting its broad appeal and swift adoption. Users enthusiastically shared their experiences, demonstrating the chatbot's versatile capabilities, from assisting with travel plans to coding computer programs.

For those seeking a brief introduction to ChatGPT, OpenAI's website describes it as follows: "We've trained a model called ChatGPT which interacts in a conversational way. The dialogue format allows ChatGPT to respond to follow-up questions, acknowledge errors, challenge incorrect assumptions, and reject inappropriate requests." This description underscores ChatGPT's advancement in natural language processing and artificial intelligence, enabling human-like interactions with computers and facilitating various applications in fields, such as customer service, education, creativity, and more.

## 2. APPLICATIONS IN BIOMEDICAL RESEARCH

A study conducted in 2023 identified over 100 biomedical articles linked to the use of ChatGPT, with six meeting review criteria.<sup>1</sup> These articles included various applications, such as drug development, composing

literature reviews, and providing medical information. To explore the potential of ChatGPT further, we will discuss the following dimensions.

### 2.1 UNDERSTANDING THE CAPACITIES OF CHATGPT

ChatGPT is engineered to generate text resembling human-like responses to input prompts, possessing an exceptional capacity to process extensive textual data and perform tasks based on natural language input. In contrast, biomedical researchers are skilled in designing and executing experiments, analyzing and interpreting findings, and contributing to scientific advancements. Hence, there exists considerable potential for biomedical researchers to leverage ChatGPT's capabilities in their work, provided they acknowledge its unparalleled strengths and potential limitations in the following domains.

#### 2.1.1 BROADER KNOWLEDGE BASE

ChatGPT boasts access to vast amounts of information across different domains, offering users expedient access to information beyond their expertise. This capability proves particularly advantageous for evaluating the viability of potential collaborations in interdisciplinary biomedical research.<sup>2</sup>

#### 2.1.2 EXPERTISE LEVELS

Despite its broad knowledge base, ChatGPT's expertise in specific domains may vary. It is imperative to acknowledge that while ChatGPT can furnish valuable insights, human experts remain indispensable, and very often are more knowledgeable for ensuring precision and credibility, particularly within intricate or specialized domains.

#### 2.1.3 LEARNING FROM INTERACTIONS

ChatGPT can continually learn from interactions with users, including experts across diverse fields. This

**Corresponding author:** Shengping Yang  
**Contact Information:** Shengping.Yang@pbrc.edu  
**DOI:** 10.12746/swrccc.v12i51.1307

learning process enhances its responsiveness and accuracy, benefiting users with varying levels of expertise. Moreover, regular engagement with ChatGPT by biomedical researchers holds the potential to substantially augment its proficiency and depth within specific biomedical domains.<sup>3</sup>

## **2.2 THE ROLE OF HUMAN OVERSIGHT AND RESPONSIBILITY**

While ChatGPT presents promising opportunities to enhance biomedical research endeavors, it should be perceived as a supplementary tool rather than a substitute for human expertise. It is essential that ChatGPT should always be seen as a helpful assistant, regardless of its sophistication.

### **2.2.1 RESEARCHERS' RESPONSIBILITIES**

Despite the ongoing development of ChatGPT and similar AI technologies, humans must retain ultimate control and responsibility in biomedical research for the foreseeable future. This perspective underscores the importance of human oversight, expertise, and ethical and legal judgment in guiding the application of AI tools like ChatGPT within the complex and nuanced realm of biomedical research.

#### **2.2.1.1 OVERSIGHT AND GUIDANCE**

Researchers must provide oversight and guidance throughout the research process, ensuring that ChatGPT is used appropriately and effectively to achieve research objectives. For instance, in collaborative research, while ChatGPT may provide information on various fields of potential collaboration, researchers must ultimately determine which collaborations are most suitable based on factors, such as their background, expertise, and the potential success of the collaboration.

#### **2.2.1.2 DATA/INFORMATION SAFETY AND SECURITY**

In studies involving ChatGPT, the biomedical researcher bears the responsibility of ensuring the safety and security of the data and information involved. Furthermore, researchers must securely handle, transmit,

and store data to protect sensitive information. In addition, researchers need to keep up with the latest developments concerning ethical, legal, and regulatory requirements, including those that may not directly pertain to their own research, e.g., "the Use of Generative Artificial Intelligence Technologies is Prohibited for the NIH Peer Review Process."<sup>4</sup>

### **2.2.2 EVOLVING CONCERNS**

As ChatGPT continues its rapid progression, its capabilities and impact are poised to expand significantly. Consequently, the quality and reliability of its suggestions and recommendations could steadily escalate, potentially exerting significant influence in decision-making processes. However, the growing reliance on ChatGPT underscores the importance of transparency, accountability, and the role of human expertise, intuition, and ethical judgment in research decision-making processes.

### **2.2.3 AN ALTERNATIVE VIEWPOINT**

In discussions on integrating ChatGPT into biomedical research, some researchers have expressed concerns about potential plagiarism in generated articles. Moreover, it is considered that ChatGPT does not meet the criteria for a study author since it cannot bear responsibility for the content.<sup>5</sup>

However, an alternative perspective suggests viewing ChatGPT integration as similar to an expert mentoring a virtual student through continuous interaction. By recognizing ChatGPT as a co-author, engaging in ongoing interactions as part of a mentoring process, and thoroughly reviewing article contents, researchers can harness ChatGPT's power in various applications while maintaining control. Given researchers' common challenge of being overwhelmed by paperwork and writing tasks, using ChatGPT to alleviate this workload could free up valuable time for genuine scientific inquiry.

## **2.3 EXAMPLE APPLICATIONS**

Here, we present a few examples of ChatGPT applications in biomedical research. However, the rapid evolution of ChatGPT may change the scope of its

applications within a matter of weeks. Consequently, numerous additional innovative and effective applications may become available.

### **2.3.1 LITERATURE SEARCH**

In contrast to popular search engines like Google and Bing, ChatGPT (depending on the version) can offer summarized search results, streamlining the process of literature review for biomedical researchers. By distilling relevant information from a vast array of sources, ChatGPT assists researchers in quickly accessing pertinent studies and findings, thereby expediting the initial stages of research exploration.

### **2.3.2 BRAINSTORMING RESEARCH IDEAS**

Despite potentially lacking the depth of expertise in specific research areas compared to biomedical investigators, ChatGPT serves as a valuable resource for brainstorming research ideas. Researchers can interact with ChatGPT to provide instant guidance and training, and receive meaningful feedback, thus augmenting the ideation process. Unlike traditional team brainstorming sessions, ChatGPT's availability 24/7 ensures continuous access to support and inspiration.

### **2.3.3 IMPROVING RESEARCH EFFICIENCY AND COORDINATION**

ChatGPT proves instrumental in enhancing the efficiency and coordination of research projects. From optimizing scheduling and task allocation to facilitating seamless communication and collaboration among team members, ChatGPT streamlines various aspects of project management. Its ability to generate concise summaries and recommendations fosters clearer understanding and smoother coordination, ultimately leading to improved research outcomes.

### **2.3.4 ASSISTING IN DRAFTING COMMUNICATIONS, APPLICATIONS, AND RESEARCH PAPERS**

While it is still debatable, if used appropriately, ChatGPT can potentially serve as a valuable assistant in drafting various communication materials, grant

applications, and research papers within the biomedical field. By providing suggestions, generating text, and offering formatting assistance, ChatGPT streamlines the writing process, thereby enhancing productivity and ensuring clarity and coherence in the final output.<sup>6</sup>

### **2.3.5 ASSISTING IN DATA ANALYSIS**

Beyond its role in facilitating the writing process, ChatGPT has the potential to assist researchers in data analysis tasks. While the current version of ChatGPT isn't inherently tailored for specific analytical tasks, with guidance and training from experts in the field, it can offer valuable insights and contribute to enhancing the efficiency and accuracy of data analysis. Moreover, ChatGPT possesses a fundamental understanding of various computer languages, laying the groundwork for further development in this area.

### **2.3.6 PROVIDING SUGGESTIONS ON ETHICAL AND LEGAL CONCERNS**

With the complex landscape of ethical and legal considerations in biomedical research, not all biomedical investigators possess formal training in these areas. ChatGPT can potentially serve as a valuable resource by providing relevant information and offering insightful suggestions to researchers seeking guidance. By acting as an alternative source of information, ChatGPT can potentially assist investigators in making informed decisions and ensuring ethical integrity throughout the research process.

## **3. OTHER CONSIDERATIONS**

### **3.1 NEGATIVE LEARNING**

While ChatGPT has the capability to learn from interactions, there exists a risk of negative learning if it receives incorrect or misleading information. This problem is known as garbage in, garbage out. To mitigate this risk, it is crucial to carefully monitor and validate both the training data and interactions with users. Employing techniques such as bias correction and fact-checking can enhance the accuracy and

reliability of AI-generated responses. In addition, fostering healthy interactions with ChatGPT is essential, and it is incumbent upon users to provide accurate information to the best of their ability. By addressing these considerations, researchers can uphold the integrity and validity of ChatGPT's contributions to biomedical research and beyond.

### 3.2 CONTINUOUS MONITORING AND ADAPTATION

As ChatGPT evolves and its applications in biomedical research expand, it becomes imperative for researchers to engage in continuous monitoring and adaptation. Regular assessment of ChatGPT's outputs ensures its suggestions align with research objectives and ethical standards. This raises the question: who will watch the watchers? Neither research objectives nor ethical standards are universally agreed upon. An early example of this dilemma was when ChatGPT decided that the misgendering of an individual today would be a greater error than the murder of millions of Jews during the Holocaust. ChatGPT does not perform objective calculations. Rather ChatGPT is being taught how to weigh the values of different things. Value is subjective, so whose values will teach ChatGPT? Will ChatGPT pursue the goals of civilization as a whole? Or will ChatGPT pursue the narrow goals of the elites who fund the project? Ongoing refinement of ChatGPT's training data and algorithms helps mitigate biases and inaccuracies, but biases are unavoidable when comparing incomparable things to make choices, and there are frequent clashes of opinion about inaccuracy. The enhancement of reliability and relevance in biomedical research settings will require constant vigilance by neutral overseers. By embracing a dynamic approach to utilizing ChatGPT, researchers can harness its full potential while safeguarding the integrity and validity of their research endeavors.

### 3.3 THE UNDERLYING COSTS

While the use of ChatGPT itself might not directly generate costs for researchers, it's important to recognize that the costs associated with developing and maintaining ChatGPT are indeed significant. For example, compared with Google, which developed algorithms

that are highly efficient and optimized for retrieving relevant information quickly from vast amounts of data, ChatGPT utilizes more complex models based on natural language processing and deep learning techniques, and the development and maintenance costs for ChatGPT are typically much higher. These costs may not directly impact society as a whole, but whoever bears the cost will most likely determine which goals are pursued by ChatGPT and whose ethics constrain choices made by ChatGPT.

As of April 2024, ChatGPT boasts an impressive user base of over 180.5 million users, with 43% of college students and 80% of Fortune 500 companies using the platform.<sup>7</sup> However, despite its vast potential, it is crucial for researchers to thoroughly understand both its capabilities and limitations and emphasize the necessity of human oversight when integrating ChatGPT into biomedical research. It's imperative for ChatGPT users to cultivate a positive learning environment, essential for the platform's healthy development and evolution. Ultimately, such efforts could render ChatGPT an indispensable asset for advancing all facets of civilization, including biomedical research.

**Keywords:** ChatGPT, natural language processing, medical research, medical publications

**Article citation:** Yang S, Berdine G. ChatGPT in biomedical research. *The Southwest Respiratory and Critical Care Chronicles* 2024;12(51):21–25

**From:** Department of Biostatistics (SY), Pennington Biomedical Research Center, Baton Rouge, LA; Department of Internal Medicine (GB), Texas Tech University Health Sciences Center, Lubbock, Texas

**Submitted:** 4/8/2024

**Accepted:** 4/17/2024

**Conflicts of interest:** none

This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

### REFERENCES

1. Ruksakulpiwat S, Kumar A, Ajibade A. Using ChatGPT in medical research: current status and future directions.

- 
- J Multidiscip Health 2023 May 30;16:1513–1520. doi: 10.2147/JMDH.S413470.
  2. Cahan P, Treutlein B. A conversation with ChatGPT on the role of computational systems biology in stem cell research. *Stem Cell Rep* 2023;18:1–2. doi: 10.1016/j.stemcr.12009.
  3. Dave T, Athaluri SA, Singh S. ChatGPT in medicine: an overview of its applications, advantages, limitations, future prospects, and ethical considerations. *Front Artif Intell* 2023 May 4;6:1169595. doi: 10.3389/frai.2023.1169595.
  4. NOT-OD-23-149: The Use of Generative Artificial Intelligence Technologies is Prohibited for the NIH Peer Review Process (last access: Apr. 8, 2024).
  5. Stokel-Walker C. ChatGPT listed as author on research papers: many scientists disapprove. *Nature* 2023;613,620–621. doi: 10.1038/d41586-023-00107-z.
  6. Gordijn B, Have HT. ChatGPT: evolution or revolution? *Med Health Care Philos* 2023. doi: 10.1007/s11019-023-10136-0.
  7. Number of ChatGPT Users (Apr 2024) (explodingtopics.com) (last access: Apr. 8, 2024).